

CONSIDERATIONS ON THE

Unhappy Accidents

That attended the last Undertaker
in his WORKS at

DAGENHAM Breach.

WITH

Remarks on the Excuses made Use of
to screen the Deficiency of the Work-
manship, in a Treatise, entitled, *An
Account of the Stopping Dagenham
Breach, &c.*

AND ALSO,

Reasons to prove, that the proper Rules
for stopping Breaches, or performing any
the like Works, contain'd therein,

And the Proposal for rendering the Port of
Dublin more commodious, are not the only
and the best in the World.

A Subject proper to be consider'd by those
whose immediate Province it is to transact for
the Good of the Nation in General.

To which is subjoin'd,

An Essay on the Perpetual Motion.

Quid te scire valet, si te scire hoc sciat alter?

By a Gentleman who was concern'd.

L O N D O N :

Printed for R. Francklin, at the *Sun* against §
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CONSIDERATIONS

ON THE

Unhappy Accidents

That attended the last Undertaker
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THE Island of *Great Britain* lying for the most Part high, it seldom happens, that any of it is overflow'd by the Tides, which makes the Inhabitants little experienc'd in stopping Inundations or Breaches, where there are great Tides, and the Flux and Reflux of the Waters are strong.

But there are sometimes Accidents of this Nature in the Levels or low Grounds; and

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as it is a Business, which to many seems easy to be perform'd, so it has been undertaken to no Purpose, with a great deal of Expence and Loss: Instances of which we have had at the Breach at *Dagenham*, before the last Undertaker attempted to stop it.

I confess, I was at first (amongst many others) induc'd to believe, that the last Undertaker's Method of stopping difficult Breaches, was the best and most effectual; and the more so, because the Commissioners or Trustees appointed by Parliament, together with several Engineers, had inspected and examin'd other Schemes, and had judg'd and approv'd the said last Undertaker's to be the best, and the only one to stop the Breach of *Dagenham*: But I found afterwards my own Mistake, and the Error of those who were so positive and strenuous in the Defence of it. Discourfing on this Subject, a Gentleman told me, " After the Breach at *Dagenham* had
 " been twice stopp'd by the last Undertaker,
 " and twice broke down again, that the Work
 " and Manner of it was better than what was
 " ever thereabouts before put in Practice, and
 " that it was not altogether impossible, but
 " it might be done in the Way he design'd
 " to go on, *viz.* to drive in more Piles, and
 " make the Dam higher and broader than
 " before.

One Gentleman indeed did, with Modesty, give some Indication of Mistakes and Errors, by saying, " That there were much better
 " Ways

“ Ways to stop Breaches, not subject to the
 “ Hazards of so many Casualties or Misfor-
 “ tunes, which this Breach had twice before
 “ sustain’d; and which were natural Conse-
 “ quences of Works, that were not according
 “ to the Art and best Manner of making
 “ Dams effectual; and that Dams could be
 “ made in much less Time, and with less
 “ Expence.

There were some who admir’d and prais’d
 the Ingenuity of the Row of dove-tail’d Piles,
 driven through the Middle of the Dam, be-
 cause of its never being before practis’d by
 Engineers in any Country: But it was an-
 swer’d, that when Dams were to be made,
 where was little or no Tide, there was no
 Occasion for Piles; and in Places where the
 Water flow’d and ebb’d as much as in this
 Place, other Methods were more proper.
 The People in Countries where Inundations
 frequently happen, knowing the Effect of
 dove-tail’d Piles very well, and using them
 often in making Sluices and Docks, and such
 like Works, would have establish’d that Me-
 thod in stopping Breaches long before now,
 if they had not been acquainted with other
 Things, which they were assur’d were more
 useful and proper for their Purpose; and that
 whatever might be advanc’d in Defence of
 dove-tail’d Piles and Chalk, would appear
 to any one of Skill and Discernment, to be
 entirely wrong, since there was such extraor-
 dinary, and much better Stuff to be had
 near this Breach; and that the driving the

dove-tail'd Piles at each Side of the Dam in the firm Ground, which was, by Nature, strong enough of itself, was rather made loose, and consequently less able to bear the Pressure of Water.

By these and the like Discourses, I began to consider on the Reasons both for and against this Method, and call'd to Mind the several Banks, Walls, and Dams of Earth I had seen at Home and *Abroad*, and in what Manner the People worked them; and by comparing them together with *the exactest Care and Examination*, I am able to lay down and demonstrate a Method of making Dams, for stopping Inundations or difficult Breaches, manifestly more effectual than any hitherto practis'd by any One in *England*, subject to none of those Hazards and Dangers which beset the Breach at *Dagenham*.

I have made some Remarks on the Undertaker's Treatise, not to find any Faults which I do not know how to mend, or to make Reflections on Persons out of Malice or Envy, but to set forth and bring to Light Difficulties and Errors of Workmanship.

Neither do I intend to take Notice of all that is written in the Treatise, because the Description of the Nature, and the Extent of the Breach, the Narration of those who intended the Stopping it, before this Author undertook it, and the unsuccessful Consequences

quences that attended them, are Subjects sufficiently given an Account of already.

Nor should I indeed find Fault with the Dam as it now stands, because it has so far answer'd the End, that it has for the most Part restored to the Land-Owners their Properties, and has secured the Levels from gulling out, and making Banks or Shoals in the River of *Thames*, which hinder the Navigation of it.

But the Author has by that Means, and by Printing his Treatise of it, brought several ingenious Gentlemen into a misguided Opinion, that his Method is the best and only one in the World.

Having mentioned how far the said Works have answer'd the Purposes they were design'd for, I shall take Notice of the Deficiency of the Workmanship, to bring the Misguided out of their Errors.

In Order to this, I think it proper to mention what a Member of the Honourable House of Commons (when this Affair lay before them) said, *viz. That Breaches would be no more Breaches, the Inhabitants being once instructed, would afterwards sufficiently know how to repair them.* Whether this has answered, or whether the Method, as laid down by this Author, is an injudicious and difficult one, I leave to the Judgment of those who
make

make due Observations on the Manner of the Works, and shall peruse these Sheets.

In Page (4) he says, " That he is very
 " sensible, by the Expressions to him, and
 " Questions which are daily asked, particu-
 " larly since his last stopping the Breach,
 " and by the Rumours about Town, that
 " ill grounded Notions have been suggested,
 " and taken Place, with Regard to the un-
 " happy Accidents which he hath met with ;
 " therefore he will, as well for the giving him-
 " self some Ease in the answering such reitera-
 " ted Questions which are put to him (by almost
 " every one he meets) as more particular-
 " ly for the better Satisfaction of such Per-
 " sons who may be able to make a Judg-
 " ment of the Truth of what he relates.

By this it seems that the Reason of his Writing the Treatise is more to vindicate his Conduct and Judgment, than to give his Readers a plain Light into the whole Affair.

The proper Persons to judge in this Case, I take to be two Sorts, *First*, Those who were concern'd in the Undertaking; and *Secondly*, Those who are skillful in, or understand such Works; and it is, I believe, by them, that the Notions he calls ill grounded are suggested; as to the former of these, they were well informed by the Assistants and Workmen, that the Marks which were set up to see or gage by, when the Dam sunk

sunk or spread out at the Sides or Bottom, were alter'd or taken away, that the Danger should not be perceived by those who were engaged for the Undertaker; that Calculations and Estimates were made short, to encourage the Proceeding; and that the Cause of the bad Success was charged on those who in Reality were not culpable; and withal, finding that what was proposed by any one but himself was ridicul'd and rejected, tho' the same being afterwards advanced as proceeding from his own Ingenuity was prais'd and applauded; considering all this, I say, they had good and well grounded Reason to think he was wrong in his Judgment; and as to the latter, they must be no less sensible that his Assertion (Page 53.) *That there is no other Way in the World, whereby it is possible to secure bad Ground, than by driving dove-tail'd Piles,* is absurd and fallacious.

It is no less absurd to affirm, (as in Page 18) *That the only true Way to stop the Water is first to secure the Ground;* for can any Body that hath a little Experience, and seen Foreign Countries, imagine, since so many considerable Dams have been made, and many Miles of Earth Walls framed in Flanders, and in many Places in Europe, besides other Parts of the World, without dove-tail'd Piles, that the People have not secured worse Ground than this at Dagenham with incomparably more Success?

It

It is the Practice of the most experienc'd in this Business, to secure the Ground without dove-tail'd Piles, and in the mean while, as the Works are carried on, to turn the Water out of the lower or back Ground; that being a much better Way than the *Only True One*, so positively and strenuously asserted, and is not subject to so many Casualties, but generally meets with desir'd Success.

It is not difficult to conceive, that if the Stuff the Dam is made with, is work'd in judiciously, and doth not bed close to the Ground, but leaves some Cavities, that the Water being forc'd or resisted by heavier or firmer Stuff from above than what is at the Bottom, must undoubtedly gull out the Ground underneath, if it was the best Ground in the World.

Again, if the Ground at the Bottom is ever so bad, and the Stuff the Dam is made with, work'd judiciously, that it bed close, that there is no Penetration for the Water, there is no Fear or Danger that the Ground should run away, as some of the Undertakers complained they could stop the Water but not the Ground. For my Part, I must say, I think the Complaint of the Badness of the Ground was unjust; for by the Observation I made on the driving in the Piles, I perceived the Ground was good, and
that

that the Manner of Working forced away the Ground, therefore the Complaint served only as an Excuse for the ill Success.

The Author observes (Page 10) " That whatsoever Breaches happen in the *Thames*, are generally occasion'd, not from any Damage of the Tide's washing down, or running over the Tops of the Banks or Walls, but from the bad Workmanship, Decay or Defect of the Sluices or Trunks which are made for the Drain of the Levels." This I will take for granted, but must add, that the Land-Owners and Workmen, not being well experienc'd in Works of this Nature, foresaw so many Difficulties, that they were disheart'ned from taking it in Hand, and so neglected it'till it came to so great a Bigness; which Omission has cost the Nation Forty Thousand Pounds, besides the Money which the Land-Owners have spent, which (if true as he observes) is more than the Value of the Lands overflow'd by the Breach.

Page 74, he says, " That he observes, that upon the Advance of the Dam in the Breach, the Force of the Stream in the Breach, (as the Works were carried on, and the Passage became contracted) began to operate with great Violence." The Observation I made on this, and the Remarks I have had in divers Countries, convince me, that the Operation of the great Violence, occasion'd by the Flux and Reflux of the

C Tides,

Tides, when the Water became contracted, was the true Occasion of the Dam's Breaking, and the other unlucky Accidents which were likely to fall on the last Method; and not the Softness of the Earth, as the Author endeavours to perswade People, to lead them into fallacious Notions to cover the Deficiencies of the Working. I observed the Earth, indeed, to be somewhat soft, (as it could not well be otherwise, being dug out, and laid on, Places continually overflown by the Tides) but withal, of as good a Nature as could be wish'd for; and I have known Breaches and Inundations stopp'd in other Countries, where there was no Chalk, with worse Earth, but work'd in a better Manner; which satisfyed me, *that his Assistants and the particular Person he points at (Page 78) had no misguided Notions.*

“ His Securities became uneasy (not without Reason) at his Conduct and Management; they did not desire bad Stuff to be used to hazard the Breaking down of the Dam, but only what was necessary to make the Works go on better; and I am of Opinion, the Dint of Labour, Care and Diligence in the Securities, was more the real Cause of compleating it, than the Skill of the Undertaker, or the Manner of Working it.

I am still the more convinc'd of this, since it appears by his Treatise, that he blames himself for following the Dictates and Directions

rections of other People, and departed from his own Scheme and Method ; altho' it is manifest, that when he did follow his own Scheme, it broke down ; and when he followed the Directions of others, it *stood* as it does now.

That the true Reason, or the great Obstruction lies in the Violence of the Water ; and the Difficulty and Mystery of stopping Breaches consists in impeding the Waters, so far, that the Tide may become easy over the Dam, is an Opinion natural to every One ; so that they who have undertaken to stop *Dagenham* Breach, have endeavoured to remove that great Obstruction by leading the Back Waters out of the Levels another Way, by cutting Canals for Trunks, Sluices, or such like Things ; and the last Undertaker, by Reason of some Observation made, alter'd his Resolution of making but One great Sluice, and made Two great Ones, notwithstanding several Trunks and Sluices were made by the Land-Owners, and those who undertook the Work before ; so that if all the Cuts and Canals that were in the Levels were measured, I believe they would not be much less than half the great Channel of the Breach, and all this Vent of Water could not hinder the Violence of the Stream breaking down the Works to the Foundation.

I cannot pass by the ill Management of making so large a Canal for a Sluice so near the great Breach, by which there was a great Hazard of the Tide's washing and breaking the Breach and Canal into One, and consequently making it more chargeable and difficult to stop; by making of which Canal, the Undertaker was depriv'd of the Advantage of good Earth near at Hand, and was forced to fetch it with more Difficulty and Expence at a greater Distance.

I cannot by any Means be induced to approve of the proper *Sett-offs* (as they are call'd) which the Dam was made with; for by them the Violence of the Stream had such a strong Hold on the Works, that it always endanger'd the Breaking it down; and I am of Opinion, that if the Dam had been made sloping, the Destruction would not have been so large every Time the Dam broke down. I have observed it to be a common Practice in *Holland*, and other Places, where Inundations frequently happen, that a gradual sloping Bank is preferr'd and made Use of before *Sett-offs*.

I shall pass by the Manner of their using Reeds and Hurdles, because I would not be tedious, or seem to be captious.

In Page 80, he says, " It had been happy
 " to have followed the Opinion of a cer-
 " tain Gentleman in an eminent Station,
 " who

" who advis'd him not to go on in such
 " Haile, but to give the Earth in the Dam
 " due Time to settle, before he attempted to
 " turn the Tides out of the Levels. I must
 beg Leave to dissent from this Opinion, be-
 cause, according to the Practice of Engi-
 neers in Foreign Countries, a great Num-
 ber of Hands are employed to carry on
 Works of this Nature briskly, to give the
 Tides less Time and Opportunity to hinder
 or do Damage to the Work, and is to be
 preferr'd before a tedious Way of Working,
 under any Pretence whatsoever.

When this Dam proved deficient, it was
 softned with the Expression of *meeting with*
some Accidents and Misfortunes, and the
 Cause was said to be some Neglect; and in
 Order to vindicate the Manner of Working
 or Building the Dam in that Method, and
 destroy the true Opinion of those who were
 concern'd, and were Eye-Witnesses of the
 ill Management, the bad Success is endea-
 voured to be remov'd by an Accompt sta-
 ted of the Weight of the Earth and Wa-
 ter, and by that Means to make Ignorant
 People believe that it is prov'd, that the
 Dam was made strong enough. But when
 this is rightly consider'd, we only find the
 Bulk and Weight proved, and not the Suf-
 ficiency of Strength to resist the Volacity
 or violent Operations of the Tide; pro-
 ving the Weight of an Hammer, and the
 Ponedrouness of the Stroke with it, is vastly
 different.

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The Arithmetical Weight of the Earth and Water, is no Proof that the Works were strong enough to resist the Violence of the Stream ; but, on the contrary, the ill Consequences, or the very ill Accidents (as they are call'd) that attended the Manner of working ; and the Arguments and Notions for carrying on the Works with few Hands in a slow Manner, are Testimonies, that the Author of the Treatise hath not the *only and best Manner of working in the World.*

And if it is taken for granted, that the Quantity of Earth and Chalk was sufficient to resist such a Quantity and Pressure of Water, as stated in the said Treatise ; it must then follow, by the Breaking of the Works, that there was an Error or Deficiency in the Manner of working ; and that the dove-tail'd Piles, and the rest of the Works, could not answer the End propos'd, viz. *To secure the Foundation on each Side, to keep in the Earth with which the Dam was fill'd, and to prevent the Dam from spreading, and settling out at the Foot and Outside :* Nay, it is evident, that the Gentleman he mentions, Page 80, and even he himself, was apprehensive of the Defects in the Fences, to keep the Earth from spreading out at the Sides, or at the Foundation : For had they been satisfy'd, that the dove-tail'd Piles and Foot Wharfs were sufficient and secure enough, they could not have imagin'd any Danger in the perpendicular settling of the Dam, nor could any ill Consequences have been suggested ;
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the Dam must only have been rais'd higher; by which, the Weight of Earth had made the Dam firmer and stronger; and if his Scheme had been right, there had been no Occasion for altering his Resolution by augmenting a large Sluice: But it is plain, that the Defect that attended his Method, which could be remov'd some other Way, is a sure Sign of Unskilfulness and Ignorance.

There is an Art and Mystery in making Dams, as well as in any Handicraft Business; and they who make it their Practice, use, in a judicious and regular Manner, chiefly Earth, or Clay, fenc'd with Reeds and Brush-work, and Implements proper for Works of that Nature; by which they surmount the Difficulties that have attended the Method of the last Undertaker.

It plainly appears by the Wall of the Levels, that a small Bank of Earth can hold out a great Quantity and Pressure of Water; therefore it may easily be concluded, that the Fault was in the Method, not in the Bulk of the Dam; and that the praising the dovetail'd Piles in the Middle of the Dam, and laying the Cause of the ill Accidents that attended, any where, but on the Unskilfulness of Workmanship, is only calculated to lead the unexperienc'd into the grossest Errors; and it is surprizing to me, that a Person, who owns he has made this the peculiar

liar Business and Study of the best Part of his Life, should be so very positive in all his Assertions, and not be able to perceive his Errors and Mistakes.

There are too many who inconsiderately judge, that any Project, attended by a Complication of Difficulties, must be the surest and best, as in the Affair before us, miraculous Effects were expected from difficult and chargeable dove-tail'd Piles; and that there was a great Mystery in securing the Ground, before they stopp'd the Water; but a little Speculation will shew, how easily they may be deceiv'd by Appearances, and vulgar Errors. It is commonly said, *The more the Danger, the more the Honour*; and this is here the Case; for had not the Undertaker met with so many Accidents, no body would have thought so well of him; they are taken to be so many Proofs of the Difficulty of it, which being at last overcome by Dint of Labour, he is of Consequence prais'd and applauded.

Plain and easy Methods are not valu'd; because when we apprehend the Reasons of any mechanical Science, our Admiration vanishes, and our Esteem is gone, and we are too prone to praise what we do not understand: By this Means obscure Systems impose on, and deceive with the greatest Confidence.

It

It has been said, that never such a Breach was stopp'd in the World, where the Tide ebb'd and flow'd so much; and that it is a wonderful Work. This I am assur'd is a Mistake, since I have been told by some of the Land-Owners, that some Years ago there was a Breach in the Levels, where the furthestmost Sluice stood; and that after some unsuccessful Attempts to stop it, a Person was sent for from a neighbouring Country, who did it to Satisfaction; nay, I am credibly inform'd, by Men of Veracity, that, in other Countries, Breaches, much more difficult than *Dagenham*, have been stopp'd without dove-tail'd Piles, with all the Success imaginable.

Further, it is to be observ'd, that they who were employ'd by the Land-Owners, in the first Attempt to stop the Breach of *Dagenham*, succeeded so far, that their Works stood more Weeks, than the last Undertaker's first Dam stood Days, altho' he then follow'd his own Scheme; and it is very probable, if the first Undertakers had proceeded with due Application of Labour after it was stopp'd, and thrown in good Earth or Clay, in all Likelihood, in that six Weeks Time that it stood, they would have been able to have made a Dam, sufficient to assist and support their first Dam, that would have answer'd their Purpose; and the Leakage, or Level's ebbing and flowing about

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three or four Feet, would not have obstructed the making the said earthern Dam.

I think I have plainly prov'd, by the foregoing Arguments, that what the Author positively asserts, viz. *That his Scheme is the best and only one in the World*, is intirely erroneous, and groundless. Altho' he seems to have sufficient Capacity, and a Faculty of expressing his Meaning well, as indeed he ought, being brought up to that Business, and having made it his peculiar Study, yet it is no Argument that he is come to the utmost Perfection, or knows every individual Thing belonging to it. Every Carpenter or Bricklayer is not an Architect, tho' he may be a good Workman; and a Gentleman may be an Architect, without being a Mechanick.

On the whole, let any one consider, that the dove tail'd Piles, the Buttresses, and the Set-offs, not having answer'd Expectation, but proving deficient, and attended with many Accidents; that the Force of the Stream, as the Passage of the Breach became contracted, began to operate with such Violence, that the Undertaker was oblig'd to dig another Canal, and add a large Sluice, to ease the Violence of the Stream on the Work, notwithstanding the great and many Cuts, Canals, Trunks, and Sluices that were thereabouts before made; besides the gulling of the Grounds, and the Complaints made by the Land-Owners, of the Dam leaking thro',

thro', and other Dangers likely to befall the third Attempt; with the five Years Time, the excessive Expence of Money and Labour; let any one, I say, consider these Things aright, and he'll own they are sufficient to deter the most resolute from following so precarious a Method.

The Considerations of the Danger, Difficulties, and excessive Expence of private and publick Treasure, that hath been bungled and squander'd away at divers Times, in sundry Places, in Works of stopping Breaches, and making Peers and Rivers navigable, should induce those, whose immediate Province it is, for the Good of the Nation in general, to make further Enquiry, and give due Encouragement to better Proposals.

The Undertaker being fallacious in his Rules for stopping Breaches, it is obvious, that he is likewise erroneous in his Principles set down for making the Port of *Dublin* more commodious.

It is natural for People to accept for Truth, (in Cases where they want Remedies or expect great Benefits) what is asserted with a great deal of Confidence, to be infallible, and the only Thing in the World; then they take for granted what they cannot contradict; and for Want of Knowledge, or duly considering what has happen'd before, applaud and extol what is of no Value or real Merit;

and they who have the most assurance in their Assertions, have generally the best Knack of perswading, and carrying their Point; for a Multitude may be influenc'd with positive Assertions, that the Jobb may seem the prettier, and the Expence not minded; " That it shall be done effectual, " and not after the common Way, but after a " new Way not hitherto practis'd; and when " once done, will, with a very small Charge, " be kept right, and endure for ever; " but it is easy to Men of Judgment and Penetration to apprehend, that a Manner of working, whereby a great Contraction of Water, and a violent Stream, and a forcing away of Ground, is made; is a Method more proper to make Peers, and Rivers navigable, than to stop Breaches.

I could enter upon a more particular Disquisition of what is aforesaid; but I fear I have already been too prolix; therefore I shall only say, that it seems to me improper to sink Trunks, Chests, or such like Machines, to make Rivers navigable; for I am well inform'd, by Men of Experience, that almost all Ships cast away, are, by the continual Motion of the Water, either worked into the Ground, or broke in Pieces; by which there are good Reasons to conclude, that it will be likewise so with Trunks or Chests, except, as the Author observes at *Dagenham*, they should be wholly driven away by the Violence of the Stream; therefore

therefore I am well satisfy'd, there are more proper Methods for such Undertakings.

I am apprehensive of some Objections against this little Treatise; but as I think it will be needless to answer all, I shall only give some few Hints of what has already been said.

And First, It is said, " That it cannot be conceived, that such a Work is or can be made without dove-tail'd Files or Chalk; and that that should be a better and more effectual Way than what has before been practis'd." To which I must answer, that if that was known, I should have no Occasion to write in this Manner; and therefore I shall say no more to this Matter till a more convenient Opportunity.

Then I am ask'd " How I am sure the Method I propose will answer Expectation, since I have never put it in Practice? To which I must say, that it doth not consist in Chimerical Projections, but in a well digested Consideration of Degrees of Volacity or Motion, as well as of Weight or Gravity, and what I have seen practis'd Abroad with great Success; and when I have sufficient Encouragement, I am capable of, and will order a Model, which when compar'd with those of the last Undertaker's at Dagenham, any one may judge which is the most reasonable and judicious. This Consideration

deration on the Degrees of Volacity or Motion, has lead me into the Essay, which I have subjoin'd.

The next Question is, Why I did not divulge this Method sooner, since I was concern'd with the Undertaker? To this I must answer, That I had not thoroughly consider'd the Volacity or Motion till some Repairs of the last Dam were made, and then it was not likely my Scheme should be accepted, since the Money already expended would have been lost, and the Works must have been begun anew; and I not being pleas'd with what was then transacted, thought it best to defer it till a more proper Season.

The Reasons I have for being displeas'd with the Management, I could enumerate; and tho' I have been injur'd, I shall decline making Reflections on any one in particular, my Design being only to expose the wrong Notions of those who believe the Undertaker's Method to be the *True and only one in the World*, and will never strive to find out another and by that Means remain for ever in their Ignorance and Errors.

I am sensible, that some of the Sticklers for his Scheme will say, that Writing on this Subject is Scribbling to no Purpose, a Thing out of Season, and not to be regarded; and because the Breach is stop't, there

there is now no Occasion for this Sort of Work, it should be look'd on, as an old Almanack, out of Date.

But the more serious, I hope, will by Enquiry find out, that the Floods on the Coast of *Holland* have been much higher of late Years than in former Times; and that since the Floods or Tides in the *Thames* have also rather increas'd than diminish'd, it is highly probable, there may be some Occasion again for Works of this Nature, * which, if practis'd, will guide ingenious Workmen to Improvements in difficult Works, such as laying Foundations, and Aprons for Sluices, Docks, Basons, &c. It will also help them in the Contrivance of the likeliest Way to lead the running of the Stream, to remove Shoals or Banks, make Rivers navigable, or hinder Rivers and Ports navigable from being choak'd up with Mud, Sand, or Beach.

Harbours or Ports are not always cur'd or mended by sinking Chests or such like Machines; Works of an other Nature are sometimes more requisite, tho' not thought on,
for

* The Author of the Account, &c. makes Mention in his Treatise, and also other Persons, of Breaches made by high Tides; but as they are nothing to the Argument of Proof, but only Perswasives to Encouragement, the Author of this takes no Notice of them, but refers to the Persons abovesaid for Information.

for Want of Experience how to make them. Had such Works been known some Years ago, I have Reason to believe, the Expence of making Ports and Rivers navigable would not have been so excessive, and so little to the Purpose ; for Defects would have been supply'd, Superfluities retrench'd, and Faults corrected.





A N
E S S A Y
O N T H E
Perpetual Motion.



THE Perpetual Motion hath, for divers Ages, been the Study of several Men of Wit and Ingenuity, and the Enquiry into it has infatuated many who have made it their Practice: There being no Study that attracts the Mind with more Probability, and deceives with more Subtle-

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ty. The Number of those who are intic'd is great, and I cannot help being one of them; however, I dissent in some Respects from those I have met with in making Experiments about it.

They, who have attempted it with a Wheel, by natural Affection of Gravity, have, in my opinion, misplac'd their Weights, and have marr'd the Elevation, that the Repair of new Strength for the Volution was not sufficient for the Retortion, and so the Motion comes to a Period; or the Wheel being made heavy and clumsy, will not go at all.

They who have made Experiments with putting Quick-Silver to slide in Boxes, to facilitate the Motion, may, perhaps, advance something that is feasible, and pretend to Mathematical Rules; but they will find that is only Conjecture, and that what may be conceived by Theory doth not always answer in Practice; the Situation of the Weight will equiponderate in the Rising, as in the going down, which will obstruct or finish the Motion, and this may be contriv'd with different Circumstances, but will all redound to the same Effect.

By observing those who set Glasses with Liquids in a Hoop, and turn them several Ways round, it is easy to be apprehended, that Quick-Silver, tho' it is of a fluid and sliding Nature, when it comes in a quick
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and even Circumvolution, will have the same Operation, as if it was solid Substance; and when it is slow or unevenly mov'd, it will quiver, or shake, and operate contrary to the Intention.

When I made Experiments, I placed the Leaver and the Prop in different Ways to the Rundle, and made several Trials, and so discover'd more Subtilties by Demonstration, than I could have conceiv'd by many Years Study; and placing of Plumets, Quick-silver, or any other Weight.

I found it impossible to contrive a Self-Motion, with a *Causa Movens* coming in a whole circular Ambulation; and this having been so often unsuccessfully attempted, hath given Occasion to a great many to conceive, that it is impossible to find out this great Secret.

It is evident by these Experiments, that there is great Difference in the Operation of the Weight, when it ponderates perpendicular, and when it comes by a Retortion in a Volution; this, as I take it, has pass'd unobserv'd by many; * therefore they have study'd, not doubting they had Mathematical Reasons for what they were going to

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* It is not meant ancient and modern Philosophers, or learned Men, but only such as I have rencounter'd, and, as they say, have try'd a thousand Ways.

put in Practice, and always found themselves with Subtilty deceiv'd.

Some have thought it possible to contrive a Wheel, with Plummets, or Weights, which by being plac'd, should be heavier in their Descent, than in their Ascent; and so have unsuccessfully sought after that great Secret, viz. *A real artificial Revolution, that shall be the Cause of itself moving*; but I think they have more study'd the Degrees of Gravity, than of real Motion; for it is reasonable to imagine, that if they had been rightly attentive on the Motion, they would have found out the Impossibility, or their Mistakes sooner. This was the Case of the Person who endeavour'd to prove, that his Dam, which twice broke down, was strong enough built: He prov'd arithmetically the Weight, or Gravity; but not the Volacity or Motion, which was the real Cause of the Destruction; so that being erroneous in his Proof, it is manifest he was defective in most Parts of his Theory; and that his Excuses for the bad Consequence, was only Evasions, to palliate his Errors.

The best Theory of this great Secret in Art, is, by a Mathematical Structure, to contrive, that the Weight which presses down the Wheel on one Side, should conduce the Leaver to lift up the other.

This being a Method never yet put in Practice by any one I know of, and perhaps
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to some Criticks may seem a Paradox, is the best Guide to the desir'd Intention, and is the most plain and likeliest Manner.

When I had the Honour to shew the Model of it to a very learned and judicious Lord, he said, " That the Theory seem'd good ; " but that he could not give his Judgment, " 'till he saw it put in Practice. *I shall also* suspend my positive Assertions how far it may be improv'd, 'till I have brought it to a greater Perfection ; however, I cannot forbear having a good Opinion of it, 'till Experience hath discover'd its Defects or Insufficiency.

They who have endeavour'd by a moving Engine to find out the Longitude, have been more attentive on the Continuation of the Motion, than the exactness of it, ascertaining, that the Perpetuity being found out, what is further necessary, will follow of Consequence.

But this Opinion, by what hath occur'd in the Experiment, seems to me falacious ; and I dare say, that a circular Motion, in a continual Revolution, (which generally is call'd a perpetual Motion) being found out, it will require several Years Practice to bring it to go true at Sea, as Clocks and Watches have had their Time to come to that Perfection they now are.

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I have further experienc'd and consider'd what hath been attempt'd to find out the Longitude, by running, or sliding, as Sand, small Beads, or little Bullets, mineral or oriental Powder, or such like Things, in Glasses, or Vessels, and have found that there are unsurpassable Difficulties in Glasses or Vessels, turn'd by a Spring, or otherwise; the Sand, Beads, &c. cannot lie close, but are of so poreous a Nature, that they will run or slide without any Vent for Air; there is likewise a considerable Difference in the Motion, proportionable to the Fullness of the Glasses or Vessels; there is also the same Inconvenience, when the sliding Substances are shak'd, that they lye closer, or when any Fire or Heat comes near them.

To give a particular Definition of it would be tedious, therefore I shall pass it by for Brevity, and go on to say, what by Experience I have found likely to be improv'd concerning this Matter. I think it possible to contrive a Vessel, of a small Compass, with a continual Duration of Motion, without being turn'd, which will last for any Space of Time in any Voyage, and what, in some Measure, may be call'd a perpetual Motion; as by some Persons Arithmetical Numbers are call'd *ad Infinitum*, because there is no Number, but there may be an Addition made to it; but those Positions are by some call'd fictitious; and it does not signify what they are call'd,

call'd, if they serve the desir'd Intention, by making Use of so much as answers our necessary Occasions.

This Vessel being contriv'd, that it is attended with the greatest Exactness, (otherwise the ocular Penetration in these Causes, are not sufficient to discern the critical Exactness of the Time) will, in a great Measure, help or take away the Inequality in the Motion; and it is susceptible of great Improvement by Practice, as most mechanical Sciences are. I am not so vain to think, that such excellent Inventions can be brought to the utmost Perfection at once; they must have the Trial and Experience of the Ingenious, and so gradually surmounting all the Difficulties, come to the desir'd Proficiency, by a Foundation of true Theory. This, in my Apprehension, is the most probable Way to find out the Difference of Time; and this Opinion doth not proceed from Notions of a confus'd System, with many Wheels, and Complications of Degrees of Gravity, nor attended with any seeming Impossibilities, as perfect Rounds, and perfect Flats, or Spheres and Globes, furnish'd with Chymical Extractions, or such like Things; but of distinct Apprehensions, of what Degree of Gravity the Motion makes to keep it equal and durable. Experience has taught, that it is impossible for any Artificer to make Two Engines exactly alike; therefore, it is requisite to seek for an *Authomaton*, whose Inequality we are able to find

find out, that we may, by perceiving the Difference, come to the Knowledge of the Exactness.

I will not pretend to bring to Light the several Attempts, the Probabilities of Success, and the Reasons of the Miscarriages in the Practice; I have only set down my Speculations and Notions of what is most proper to *come to Use*, and by setting forth some Errors, endeavour'd to guide, from Stumbling-Blocks, those who intend, and are able to make Experiments of Things of so excellent Curiosity; for nothing in this Kind can be perfectly determin'd without particular Trial; to which is necessary an ingenious Artificer, as well as good Circumstances. I am very sensible, that a Theory without Experiments, is only Conjecture without Certainty: And it is none of the meanest Hindrances, that the Inventors, not being Mechanicks, are forc'd to have Recourse to the Help of Artificers, who generally impose on them, and demand excessive Prices for such *Out of the Way Work*, as they call it; besides, they are so inquisitive, that they seem more attentive on the Thing itself, than the making of it, being always willing to appropriate the Invention to themselves, which naturally creates a Suspicion of Piracy; and so good Intentions are often postpon'd, or expire in the *Embria*.

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There are some Inventors, who are not willing to make their Knowledge common, to bring it to Contempt; because vain, impertinent, and conceited Persons, will jeer and ridicule those Things, which they afterwards endeavour to perswade are of their own Invention: By which Means, Posterity is depriv'd of the Benefit of many Discoveries; and the Authors are only pleas'd with their Speculations, like Misers with their Wealth, which they make no Use of.

F I N I S.



There are some persons, who are not
willing to make their knowledge common,
to bring it to contempt; and who vainly im-
parting, and concealed notions, will jest
and ridicule those things which they either
want or are unable to give. It is their
own invention: by which means they
are deprived of the benefit of man's expe-
rience; and the Author is only pleased with
their speculations, like others with their
theories, when they make a rule of

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